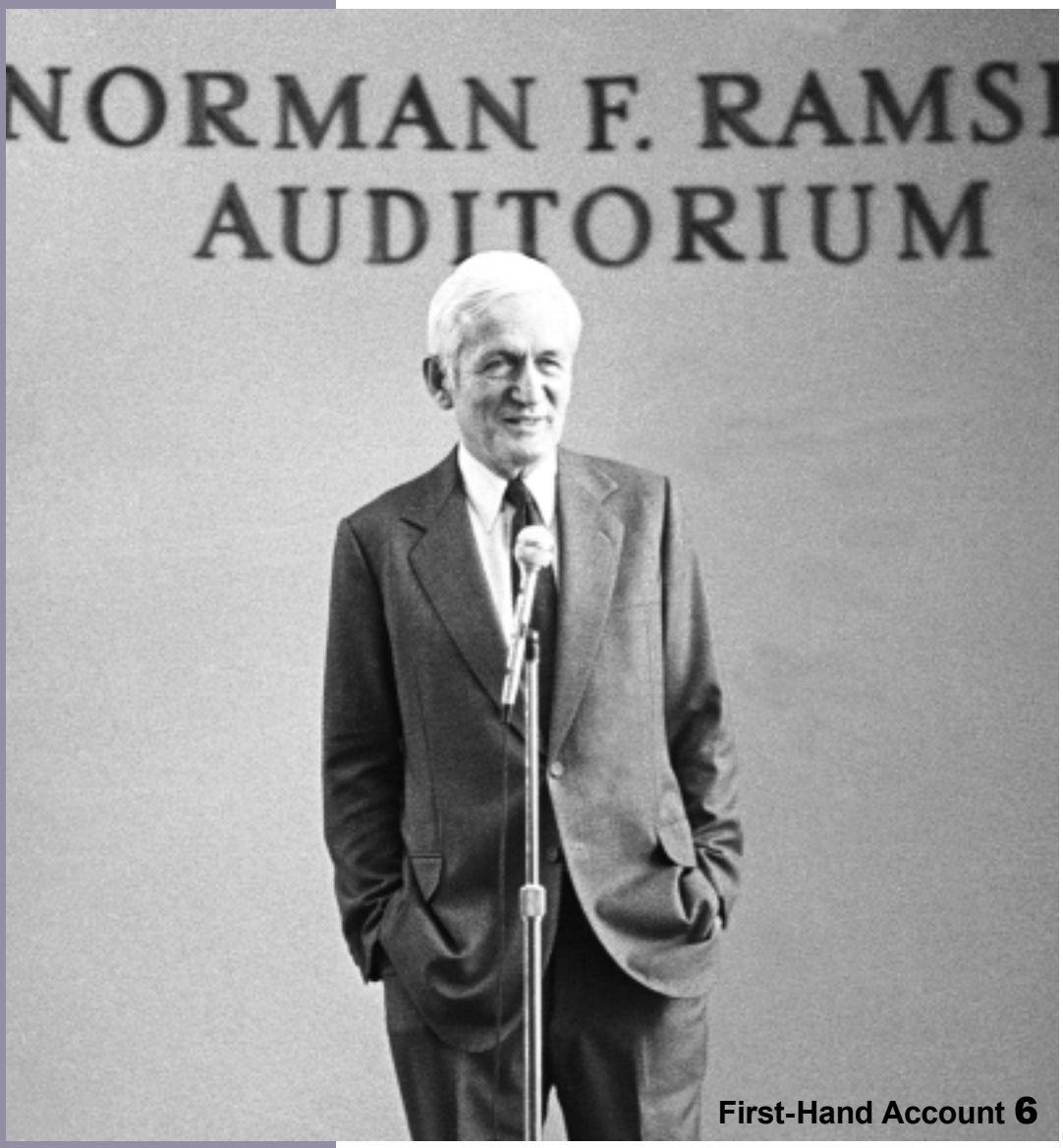
FERMI NEWS

FERMILAB A U.S. DEPARTMENT OF ENERGY LABORATORY



Fermilab photo

First-Hand Account 6

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INSIDE:

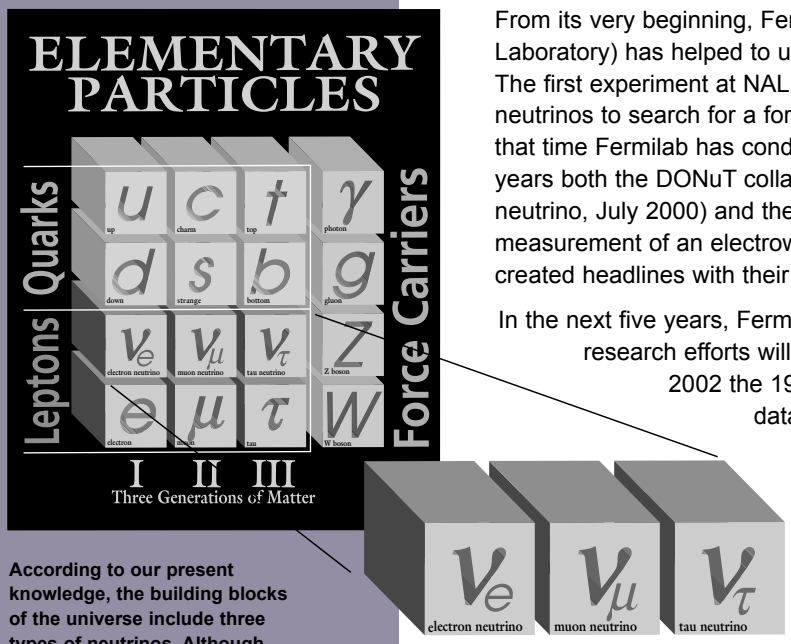
Cracking the NEUTRINO CODE

by Kurt Riesselmann

Neutrinos are everywhere. Capable of traversing the entire earth at close to the speed of light, these particles shine no light, and only very rarely does one of them interact with anything at all. Penetrating every corner of the universe, billions of neutrinos cross your body in a tiny fraction of a second.

From its very beginning, Fermilab (originally called the National Accelerator Laboratory) has helped to unravel the secrets of these ghost-like particles. The first experiment at NAL, labeled E1A and proposed in June 1970, used neutrinos to search for a force-carrying particle called the W boson. Since that time Fermilab has conducted numerous neutrino experiments. In recent years both the DONuT collaboration (first direct observation of the tau neutrino, July 2000) and the scientists of the NuTeV experiment (precision measurement of an electroweak-force parameter, November 2001) have created headlines with their scientific results.

In the next five years, Fermilab's contributions to the worldwide neutrino research efforts will come from two new experiments. In September, 2002 the 19-million-dollar MiniBooNE detector began taking data on neutrino collisions, and in early 2005 the 171-million-dollar NuMI project will send neutrinos produced by Fermilab accelerators to the MINOS detector in Soudan, Minnesota. Thanks to these experiments Fermilab will continue to be one of a handful places in the world to play a major role in revealing neutrino secrets in the years to come.



According to our present knowledge, the building blocks of the universe include three types of neutrinos. Although experiments have unveiled that neutrinos transform into each other, the details of the oscillation process are yet to be fully understood.

Predicted by theorist Wolfgang Pauli in 1930, the neutrino resisted direct experimental evidence until the 1950s, when a Nobel Prize-winning experiment at a nuclear reactor at the Savannah River Plant, South Carolina recorded the first neutrino interactions with matter. Over the last fifty years scientists have identified three types of neutrinos: electron neutrinos, muon neutrinos, and tau neutrinos, all considered to be massless. It wasn't until results from the Japanese Super-Kamiokande experiment in 1998 that the scientific community realized that neutrinos do have mass.

When a sports car becomes a minivan

The discovery of neutrino mass, however, created many new questions. Massive neutrinos show a peculiar behavior: neutrino oscillations, the in-flight transformation of one type of neutrino into another. Completely unknown in the macroscopic world, this quantum effect is equivalent to a sports car morphing into an SUV or perhaps a minivan, only to change back into a sports car many miles farther down the road. If a highway initially featured only sports cars, it would soon be populated with a mixture of all three types of cars.

Last year, advances in neutrino oscillation research created headlines in newspapers and magazines all over the world. The Sudbury Neutrino Observatory in Canada reported results on solar neutrino oscillations, the transformation of electron neutrinos emitted by the sun into the two other types of neutrinos. The Japanese KamLAND experiment observed the "disappearance" of electron neutrinos emitted from several nuclear reactors. These disappearances were again attributed to neutrino oscillation. The K2K experiment, which analyzes a beam of muon neutrinos produced by an accelerator 250 kilometers away at the KEK laboratory in Japan, saw indications for the transformations of those accelerator-made neutrinos, too.

Topping off last year's neutrino success stories, two neutrino scientists shared half of the 2002 Nobel Prize in physics for their pioneering work in detecting cosmic neutrinos. Beginning in the 60s, Ray Davis conducted a groundbreaking 30-year-long experiment to detect solar neutrinos in a gold mine in Homestake, South Dakota. Masatoshi Koshiba headed the Kamiokande experiment in a zinc mine in the Japanese Alps, confirming Davis's results. In 1987, the Kamiokande experiment stunned the world by recording neutrinos emerging from a distant supernova explosion.

"2002 has been a miracle year for neutrino physics," said Maury Goodman, physicist at Argonne National Laboratory and publisher of the electronic Long-Baseline Neutrino Newsletter. "Now there is a huge amount of effort, thinking about future neutrino experiments."

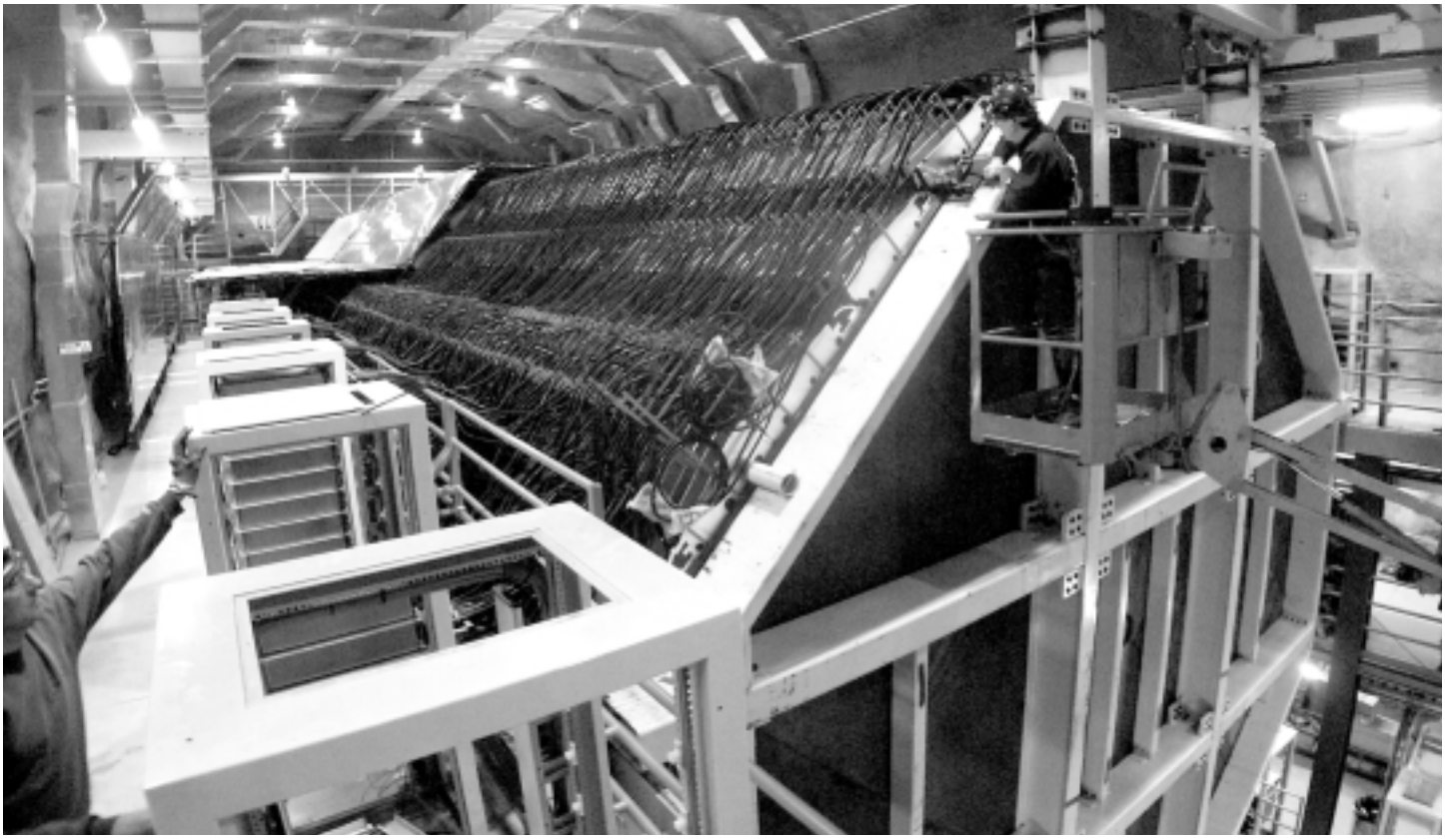
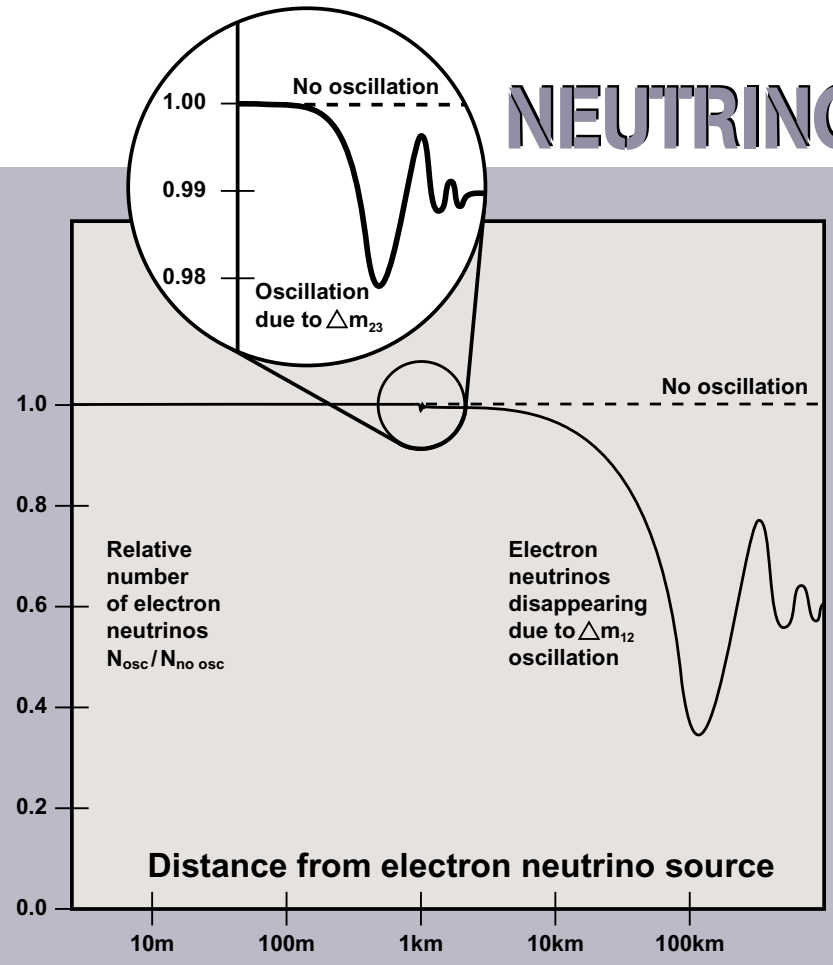


Photo by Jerry Meier

The MINOS neutrino detector in Soudan, Minnesota will consist of 485 layers, each one and a half inches thick and weighing 12 tons. Technicians like Dan Marolt (left) erect the planes by clamping them to an iron frame. From a bucket lift, technician Brian LaFrenier, University of Minnesota, checks the placement of plane 393 and releases one of the clamps. The MINOS experiment will measure the oscillation properties of a muon neutrino beam produced by accelerators at Fermilab.

NEUTRINOCODE



Tracking down disappearances

Due to neutrino oscillations, a pure beam of, for example, electron neutrinos transforms into a mixture of electron neutrinos, muon neutrinos, and tau neutrinos. The oscillation frequency depends on the differences between the three neutrino masses (Δm_{12} and Δm_{23}) and the neutrino beam energy. To measure the "disappearance" of electron neutrinos due to Δm_{12} (large effect) and Δm_{23} (small effect, highlighted in inset), scientists need to build detectors at the right distance from the neutrino source. Because any neutrino beam encompasses a range of neutrino energies, the oscillation amplitude decreases over distance and "averages out," leading to a constant disappearance effect at large distances. (Note: The periodicity of the sine-squared curve is distorted due to the use of a logarithmic scale for the distance.) Physicists are also studying the corresponding oscillation curve for beams of muon neutrinos.

ARE THERE THREE OR FOUR?

The MiniBooNE experiment at Fermilab will provide important input for scientists planning future experiments. Most theoretical models assume three types of neutrinos to be involved in neutrino oscillations, which are described by a small number of mixing parameters that can be determined experimentally. However, the neutrino observations recorded in the 1990s by the Liquid Scintillator Neutrino Detector (LSND) at Los Alamos don't fit into the three-neutrino model that describes all other experiments so far.

"It's hard to make progress in neutrino physics without resolving the LSND question," said John Beacom, astrotheorist at Fermilab. "No experiment other than MiniBooNE is touching that. The KARMEN experiment [conducted a few years ago in England] didn't have the sensitivity to fully test the LSND results. If MiniBooNE confirms LSND, then either there are sterile neutrinos or something else at least that dramatic for physics and astrophysics."

Taking into account all experimental results from around the world, the data obtained by the LSND collaboration suggests the presence of four neutrinos. Theorists refer to the extra neutrino, which must be even less interactive than the three standard neutrinos, as the sterile neutrino. By conducting an independent measurement in the next few years, the BooNE collaboration will either confirm or refute the LSND results. If the initial MiniBooNE experiment confirms the LSND oscillation effect, scientists hope to build a larger detector, called BooNE, to study the effects of the sterile neutrino in detail.

MINOS TO PROVIDE ANSWERS

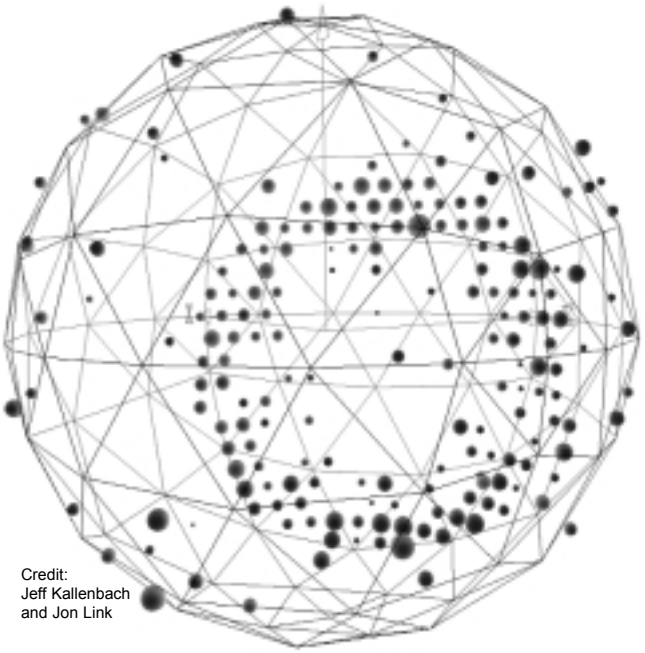
Even without a fourth neutrino, it will take many more years to fully understand the various mixing processes taking place among the three standard neutrinos. The probability with which neutrinos transform into each other depends on the energy of the initial particles ("speed of the sports cars"), the differences in mass among the three neutrino types ("weight of sports car vs. SUV vs. minivan"), the mixing angles that are characteristic for transitions between two neutrino types ("the propensity for a change between two types of cars"), and the distance the initial neutrinos have traveled from their point of creation ("miles driven on the highway"). The result is a characteristic oscillation curve (see graphic above). The neutrino source (sun, atmosphere, reactor, accelerator) and the distance between source and neutrino detector determine the capability of each neutrino detector to measure the various mixing parameters.

The MINOS experiment, presently under construction, relies on two detectors that will analyze a muon neutrino beam created by Fermilab accelerators. The near detector, located on the Fermilab site, will examine the composition of the beam less than a kilometer after its creation. The far detector, located in Minnesota, will probe the composition of the neutrino beam a second time, after it has traveled 735 kilometers.

"The new Fermilab muon neutrino beam line allows for lab-based tests of atmospheric neutrino oscillations," said Beacom, one of several Fermilab theorists investigating neutrino models and their implications. "The Super-Kamiokande results indicate that muon neutrinos [created in the earth's atmosphere] mostly transform into tau neutrinos. The MINOS experiment will measure the corresponding mass difference Δm_{23} and the mixing angle θ_{23} very precisely."

These measurements are crucial to establishing what scientists call the mass hierarchy among the three types of neutrinos. The results are, however, just a beginning. With the new muon neutrino beam line, Fermilab is in an excellent position to do more.

"The long-term goal is CP violation," explained Fermilab theorist and neutrino expert Stephen Parke, referring to the puzzling fact that antineutrinos could actually behave differently from neutrinos. "With an additional off-axis detector, the Fermilab muon neutrino beam can be used to look for oscillations into electron neutrinos. If nature cooperates, we could even study CP violation."

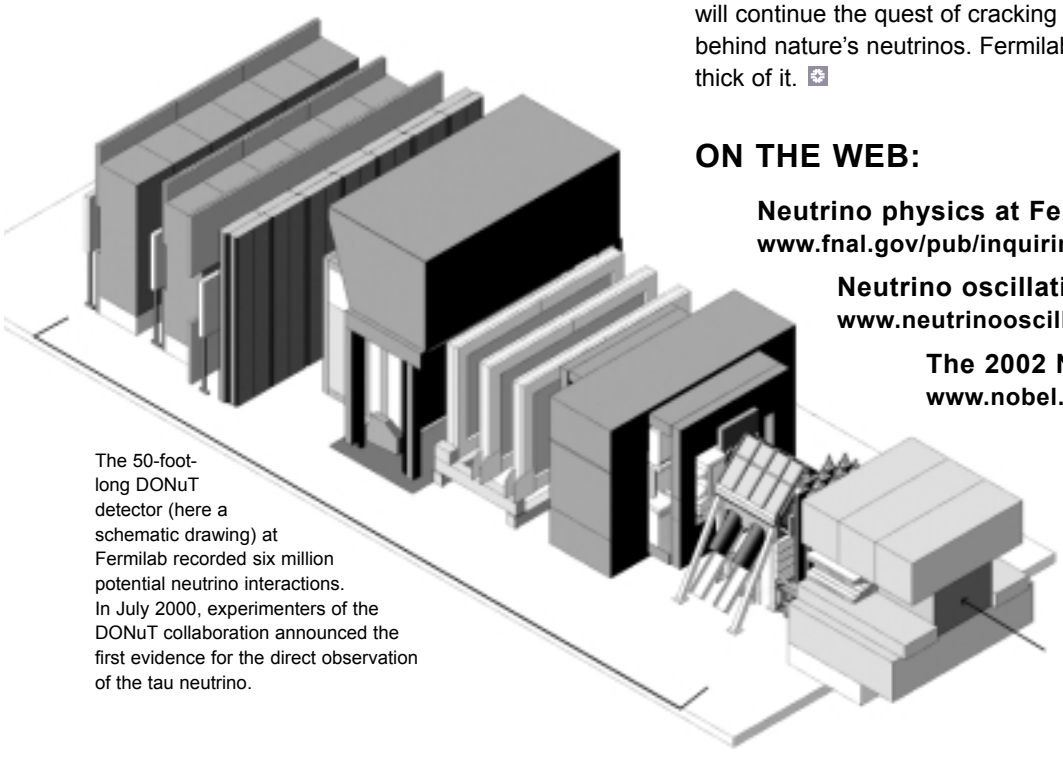


Credit: Jeff Kallenbach and Jon Link

The MiniBooNE experiment at Fermilab will confirm or refute results obtained by the LSND collaboration that hint at the existence of a fourth type of neutrino with properties very different from the three kinds known so far. The graphic shows a muon neutrino event recorded by the BooNE collaboration in September 2002.

Such an experiment, located one to two degrees from the central axis of the muon beam, would catch neutrinos within a narrow energy range. It might allow scientists to measure the final parameter θ_{13} of the neutrino mixing matrix, which holds the key to measuring CP violation among particles other than quarks. So far, this type of CP violation has eluded experimental detection.

In years to come, laboratories around the world will continue the quest of cracking the secret code behind nature's neutrinos. Fermilab will be in the thick of it.



The 50-foot-long DONuT detector (here a schematic drawing) at Fermilab recorded six million potential neutrino interactions. In July 2000, experimenters of the DONuT collaboration announced the first evidence for the direct observation of the tau neutrino.

ON THE WEB:

Neutrino physics at Fermilab
www.fnal.gov/pub/inquiring/physics/neutrino/

Neutrino oscillation experiments around the world
www.neutrinooscillation.org/

The 2002 Nobel Prize in physics
www.nobel.se/physics/laureates/2002/

NOTE: A series of lectures this spring at Fermilab will bring together scientists to discuss future neutrino projects. The first lecture will be offered Thursday, March 6, by John Wilderson of the University of Washington.

First-Hand Account

Norman Ramsey, Colloquium speaker on February 26, has faced the real issues of scientists in times of war

Norman Ramsey, first president of Universities Research Association, Inc., in 1974.

COVER PHOTO:
Norman Ramsey speaking at the 1981 dedication of Ramsey Auditorium at Wilson Hall.

ON THE WEB:

Norman F. Ramsey–Autobiography
www.nobel.se/physics/laureates/1989/ramsy-autobio.html

Fermilab Colloquium Calendar
www-ppd.fnal.gov/EPPOffice-W/colloq/colloq.html

by Mike Perricone

Norman Ramsey has seen too much history to risk predicting the future, especially for the intervening weeks until his Feb. 26 Fermilab Colloquium presentation on "Scientists in Times of War."

"The circumstances surrounding my giving the talk may be rather different by then," he said, as February opened with tensions unresolved over weapons inspections in Iraq.

Whatever the circumstances, the talk will not be an academic exercise for Ramsey.

Before chairing the advisory committee that recommended establishing a national accelerator laboratory; before serving as the first president of Universities Research Association, Inc., the consortium contracted to run the laboratory; before having Fermilab's Ramsey Auditorium named for him; before winning the 1989 Nobel Prize in physics for developing the maser, used in atomic clocks; before launching his decades-long search for an electric dipole moment in the neutron….

That's a lot of history right there, but even earlier than all those achievements, Norman Ramsey played a significant role in history when the world was at war and scientists were needed to develop weapons and defenses.

Before the U.S. formally entered World War II, Ramsey headed the group developing three-centimeter radar at the MIT Radiation Laboratory—and radar was regarded as the decisive factor for the Royal Air Force in the Battle of Britain. Ramsey joined the Manhattan Project in 1943 and served as Head of the Delivery Group at Los Alamos when the first atomic bomb was built and tested.

"In World War II, it was clear who were the good guys and who were the bad guys," Ramsey, now 87, said from his home in Boston. "I think there's rarely been a war for which the distinctions were so clear—who started it, what aggressions preceded it. This is a moral help to scientists or anyone else in a war, because there are so many terrible aspects. It's worth spending a great deal of effort on that moral distinction. One of the worries in the present situation may be that it [the moral distinction] is not quite so clear. It poses a dilemma in a certain sense. The problem is not that the applications of science aren't effective. On the contrary, they are very effective. That means killing a lot of people. That's very difficult to have on your conscience, at the time and subsequently."

Ramsey catches up on some old stories with Ned Goldwasser, the lab's first deputy director, during the March, 1999 symposium "The Early Days of Fermilab," celebrating Goldwasser's 80th birthday.

In his talk, Ramsey will touch on the play, "*Copenhagen*," and the book, "*Tuxedo Park*," both achieving popularity with their themes of science and scientists

Fermilab photos

Yes, that is indeed a dog Ramsey is holding in his coat on the fiercely windy Saturday, May 11, 1974 when the National Accelerator Laboratory was renamed Fermi National Accelerator Laboratory. The dog belonged to Dixy Lee Ray, chair of the U.S. Atomic Energy Commission. "I used to jokingly point out that this was the primary responsibility of the president of URA," Ramsey said. "The auditorium wasn't finished yet, and Bob Wilson wanted all the employees to be at the ceremony, and that meant holding it outside. It was raining and the wind was blowing, and we asked the Italian priest from Chicago, who was advocating the Fermi renaming, figuring he might have a direct line. He said it would stop raining, but we didn't ask him the right question. The wind came up vastly greater. We were worried about the temporary podium blowing over. It came time for Dixy Lee Ray to talk, and the question was what to to with her dog, who went everywhere with her, and I volunteered to hold it on my lap."

in times of war. "*Copenhagen*" explores the relationship between atomic scientists Niels Bohr and Werner Heisenberg, and the issue of whether Heisenberg helped or hindered the atomic bomb program of Nazi Germany.

"I knew Heisenberg only slightly, but I knew Bohr well," Ramsey said. "Bohr was a very fine person."

And then there's the story of shadowy financier and amateur scientist Alfred Lee Loomis, who helped establish the MIT laboratory, built his own science enclave in Tuxedo Park, New York, then applied his wealth and political connections to nudging the U.S. effort to build the first atomic bomb.

"I think the book exaggerates his technical expertise," Ramsey said, "but he did a lot to get the [radar] project moving rapidly through the government. He also did a lot to get nuclear weapons work going. He had very strong judgment, he was very vigorous in pushing things, and he had money. He had a lot of money. Those were the days before rental cars, and in every city he went to, he had a limousine and a driver."

Ramsey has also done his share of moving projects along. He was instrumental in founding Brookhaven National Laboratory, headed the physics department at Harvard University, and in 1962 was tapped to chair a committee to formulate recommendations on the future of U.S. high-energy physics over the next decade.

The report of his group, and of a subsequent design committee from Berkeley Lab, pointed the way to establishing a national accelerator laboratory operated by a consortium of universities. The original group of 30 universities formed a board of scientists and non-scientists, then formed a smaller board that could work more effectively—the smaller group including Ramsey and Robert Rathbun Wilson of Cornell University.

"The board of trustees was mainly worried about the selection of a director, and was compiling a list during the site selection process," Ramsey recalled. "When the Illinois site was finally selected, the Berkeley people were very disappointed, and one of their guys turned it down. Bob Wilson was on the board, but he was regarded as ineligible. He was finishing up the Cornell accelerator lab, and the trustees felt that if he abandoned that project, he wasn't responsible enough to be a good director. Well, typical of Bob Wilson, he finished the Cornell project a year ahead of schedule. So he was available. I was chosen as the first president of URA, and Bob and I worked very well together."

Ramsey continues to work at Harvard, on the goal he has pursued for more than four decades: finding an electric dipole moment in the neutron.

"It's still a very open and fundamental question," he said. "I'm 87 years old, but I'm not giving up."

Tough Days Ahead with FY04 Science Funding

But at URA Council of Presidents, Marburger and Boehlert predict improving long-term outlook

by Mike Perricone

WASHINGTON, D.C.—As Director of the Office of Science and Technology Policy, and chief science advisor to the President of the U.S., John Marburger has found that being on the inside doesn't always translate into a comfort zone.

"I've never been this close to the budget process before, and it's a harrowing experience," Marburger told the Council of Presidents of Universities Research Association, Inc., at its annual meeting on January 30 at the National Academy of Sciences.

Marburger's budget previews, coupled with the February 3 release of President Bush's budget proposal for FY04, gave signs of more harrowing days ahead for high-energy physics. At least in the short term, the old optimist-pessimist argument could currently reduce to whether the budget was one-third full or two-thirds empty.

With the complicating factor that Congress has yet to approve discretionary spending for FY03, funding for the field of high-energy physics is due for a 1.8% increase. With no current budget enacted, that percentage of increase is based on the Amended Request for FY03 in the Department of Energy's Office of Science. High-energy physics actually did slightly better than the Office of Science as a whole, which registered a 1.4% gain over the FY03 Amended Request (1.4% is approximately the rate money market funds are drawing at the bank).

John Marburger

"Actions by the new congress [on pending FY03 legislation] will include 3% across-the-board cuts to pay for new initiatives," Marburger said. "The science advances we worked very hard for will be wiped out. That's disturbing, but that's the way it's worked out."

Marburger knows this landscape well, as the former Director of Brookhaven National Laboratory, and as a former Chairman of the Board of Trustees for URA. He added that even increases for the National Science Foundation might not be on track for the mandated doubling of NSF funding over the next five years.

While the news wasn't especially good, neither was it especially surprising. And there was a guarded sense of possible improvements in years ahead.

"We understand that our national priorities and the state of the economy make this a tough budget year," said Fermilab Director Michael Witherell, after the budget numbers were released. "However, it will be very difficult under the FY2004 budget for Fermilab to carry out our scientific research

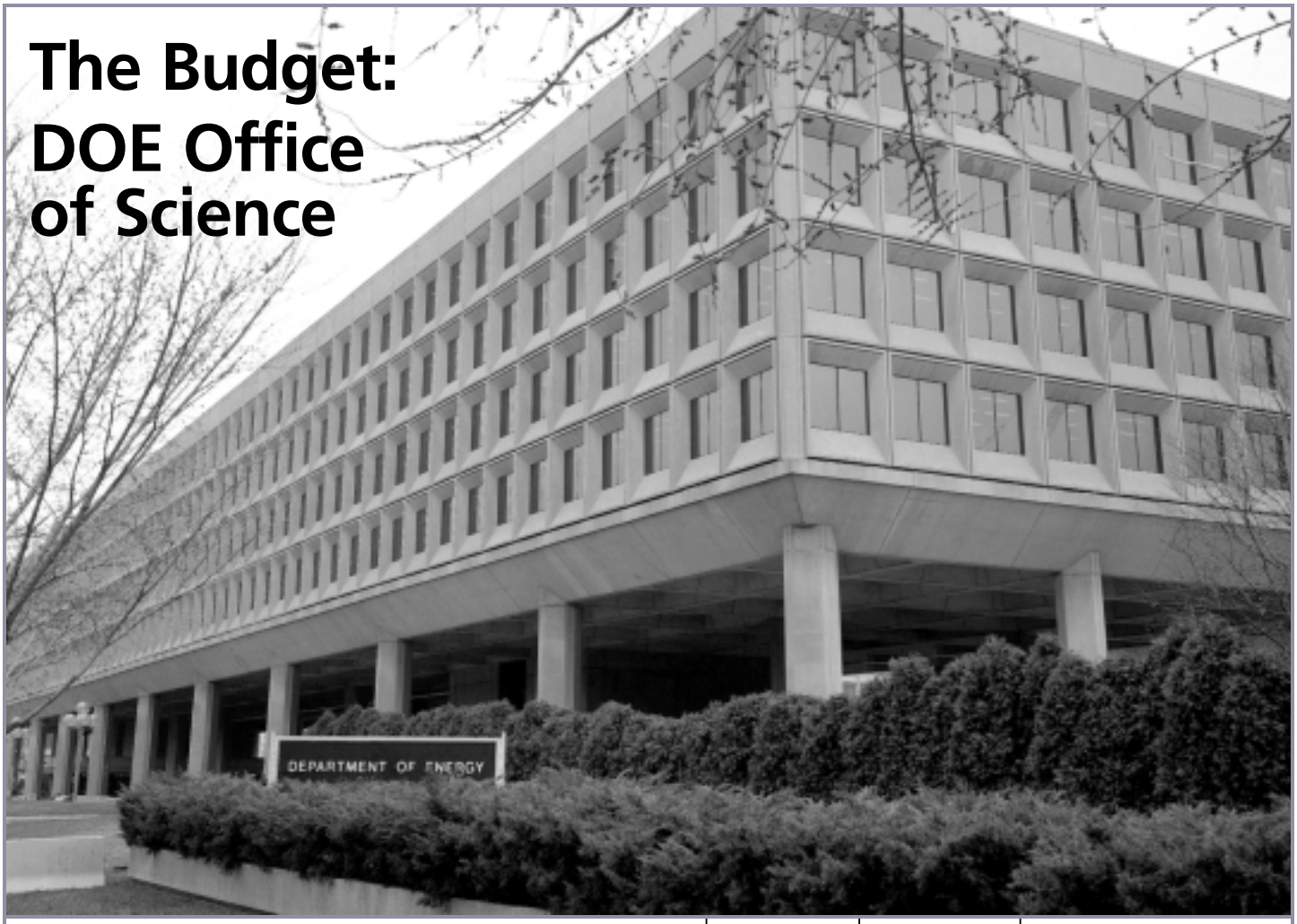
ON THE WEB:

Universities Research Association, Inc.
www.ura-hq.org

PCAST report on Assessing U.S. R&D Investment
www.ostp.gov/PCAST/pcast2002rpt

Office of Science and Technology Policy
www.ostp.gov

The Budget: DOE Office of Science



(dollars in thousands)	FY 2002 Comparable Approp	FY 2003 Amended Request	FY 2004 Request to Congress	FY 2004 vs. FY 2003	
Science					
High-energy physics	697,383	724,990	737,978	+12,988	+1.8%
Nuclear physics	350,589	382,370	389,430	+7,060	+1.8%
Biological and environmental research	554,125	484,215	499,535	+15,320	+3.2%
Basic energy sciences	979,560	1,019,163	1,008,575	-10,588	-1.0%
Advanced scientific computing research	150,205	166,557	173,490	+6,933	+4.2%
Science laboratories infrastructure	37,125	42,735	43,590	+855	+2.0%
Fusion energy sciences program	241,100	257,310	257,310	——	——
Safeguards and security	50,230	48,127	48,127	——	——
Program direction	149,467	137,332	150,813	+13,481	+9.8%
Workforce development for teachers and scientists	4,460	5,460	6,470	+1,010	+18.5%
Small business innovation research (SBIR)	99,668	——	——	——	——
Subtotal, Science	3,313,912	3,268,259	3,315,318	+47,059	+1.4%
Less security charge for reimbursable work.	-4,460	-4,383	-4,383	——	——
Total, Science	**3,309,452**	**3,263,876**	**3,310,935**	**+47,059**	**+1.4%**

Photo by Reidar Hahn

Muge Karagoz Unel, of Northwestern University, offered OSTP Director John Marburger a personal poster session on Beam Halo Monitoring at CDF, during Marburger's visit to Fermilab on August 1, 2002.

mission. We are encouraged by the growing recognition in Washington of the need for increased support of the physical sciences, and we hope this will translate into funding increases for high-energy physics and for Fermilab in the years ahead."

In fact, Marburger held out hope to the URA gathering for future budget increases. He cited the preamble to the FY04 budget, which includes a recommendation from the President's Council of Advisors on Science and Technology (PCAST) for increased funding in the physical sciences.

"It's important to look at the language in the budget, in a year where there's not as much money in the treasury as we hoped," Marburger said.

The report by the PCAST Panel on Federal Investment in Science and Technology and Its National Benefits, chaired by president G. Wayne Clough of Georgia Institute of Technology, made this its first recommendation:

> *"All evidence points to a need to improve funding levels for physical sciences and engineering. Continuation of present patterns will lead to an inability to sustain our nation's technical and scientific leadership. We recommend that beginning with the FY04 budget and carrying through the next four fiscal years, funding for physical sciences and engineering across the relevant agencies be adjusted upward to bring them collectively to parity with the life sciences."*

Rep. Sherwood Boehlert (R-NY), chair of the House Science Committee, added his belief that the future outlook for R&D is "reasonably good." He cited both the current focus on security issues, and what he saw as an emerging consensus on the need for research funding.

"The emphasis on Homeland Security could presage R&D spending over a wide range," Boehlert said. "The war against terrorism will be won as much in the laboratory as on the battlefield…Both Congress and the Administration realize that a large increase in research spending is long overdue. We have the House and Senate on the same wavelength on science funding, and that hasn't always been true. The stalemate over appropriations is the result of a larger breakdown in the process. Science funding has stayed out of the target range of ideological conflict."

If an improved outlook does come to light, Boehlert acknowledged there would be countless questions about priorities. But responding to a question from the floor, Marburger was clear on one priority for high-energy physics—the next big accelerator, with the main issues surrounding how to get it built.

Marburger, Boehlert Lament Visa Backlog

WASHINGTON, D.C.— OSTP Director John Marburger told the URA Council of Presidents that "the science of the nation is suffering" because of the backlog on visa applications for visiting scientists from other nations.

Marburger, chief science advisor to President Bush, said he has met with Secretary of State Colin Powell and National Security Advisor Condaleeza Rice, and "they agree this is a problem, an issue that needs to be addressed." Marburger also said "Congress is very interested" in the situation, a motion firmly seconded by Congressman Sherwood Boehlert of New York's 23rd District, chair of the House Science Committee.

"You better believe we're paying close attention to the visa problems," Boehlert said, answering a question from the floor. "We're very mindful of the situation…You should expect and demand that we pay attention… Quite frankly we need to do a lot of things to speed up the process."

Fermilab director Michael Witherell, citing a memo outlining new DOE-mandated identification requirements for all visiting scientists at the lab, put the issue in a context of "trying to preserve the academic research environment."

"It's much broader than just the labs, it applies to all universities," Witherell said. "If [researchers] do get into the country, how do we have them operate freely on the site with tools they may themselves have built?"

Boehlert placed the visa problem on a level with what he regards as two other primary challenges for U.S. science.

Said Boehlert: "If we don't think in the long term, if we don't address K-12 science education, if we don't address the visa problems—boy, are we going to suffer as a nation."

—Mike Perricone

"The linear collider is the right kind of machine to build, but it's very expensive," Marburger said. "What's needed to convince [the Office of Management and the Budget] on funding for linear collider research, is a lot more work on the international roadmap to be followed for the necessary work on this project. My office has some ideas on how this can be done. We will be talking with the Department of Energy and OMB, and see what we can come up with."

Marburger backs the concept of an international laboratory. But he is known to be concerned that a model for the project management must emphasize accountability to all the governments involved, and must ensure the financial support of all the governments involved.

Witherell assured the Council of Presidents that Fermilab and the U.S. have met their obligations well for Large Hadron Collider magnets and Compact Muon Solenoid detector components for CERN, the European Particle Physics Laboratory. He said the lab was looking forward to presenting early results from Collider Run II of the Tevatron at the major conferences next summer, which he described as "a benchmark for the field."

Under Secretary of Energy Robert Card, who has line responsibility for departmental operations in energy, science, and the environment, reported being "very impressed with what I saw" on his visit to Fermilab and stressed the need for "continuing this impressive legacy." He added: "We need to make sure the lab has the institutional stability to achieve its scientific goals."

National Science Foundation director Rita Colwell focused on the decisions that are being made on science and security, urging scientists to be "active partners in formulating policies, or else it will be done without our insight, reason and wisdom."

As a former laboratory director, Marburger is also well acquainted with the need for openness in scientific work, and he expressed concern for maintaining a balance with security issues. He also emphasized the differences among DOE laboratories.

"We need an ongoing discussion of the roles of the labs, and on the balance of openness and security," Marburger said. "Not all the labs are the same. We have to take into account their differences. For example, labs with very large university-based user communities have to operate in ways that make the lab accessible to those users. That has to play a large role in security arrangements at labs like Fermilab."

Rep. Sherwood Boehlert (R-NY), chair of the House Science Committee

BATAVIA CELEBRATES

link to energy frontier, with Fermilab and with windmills

ON THE WEB:

Batavia Historical Society:
www.bataviahistoricalsociety.org

City of Batavia
www.cityofbatavia.net

Batavia Park District:
www.batpkdist.org

DOE Wind Energy Program
www.eere.energy.gov/wind

American Wind Energy Association
www.awea.org

by Elizabeth Clements

When the U.S. Atomic Energy Commission selected the former farming village of Weston, Illinois as the site of its planned new national accelerator laboratory, the official address of the new lab was identified as Batavia, Illinois.

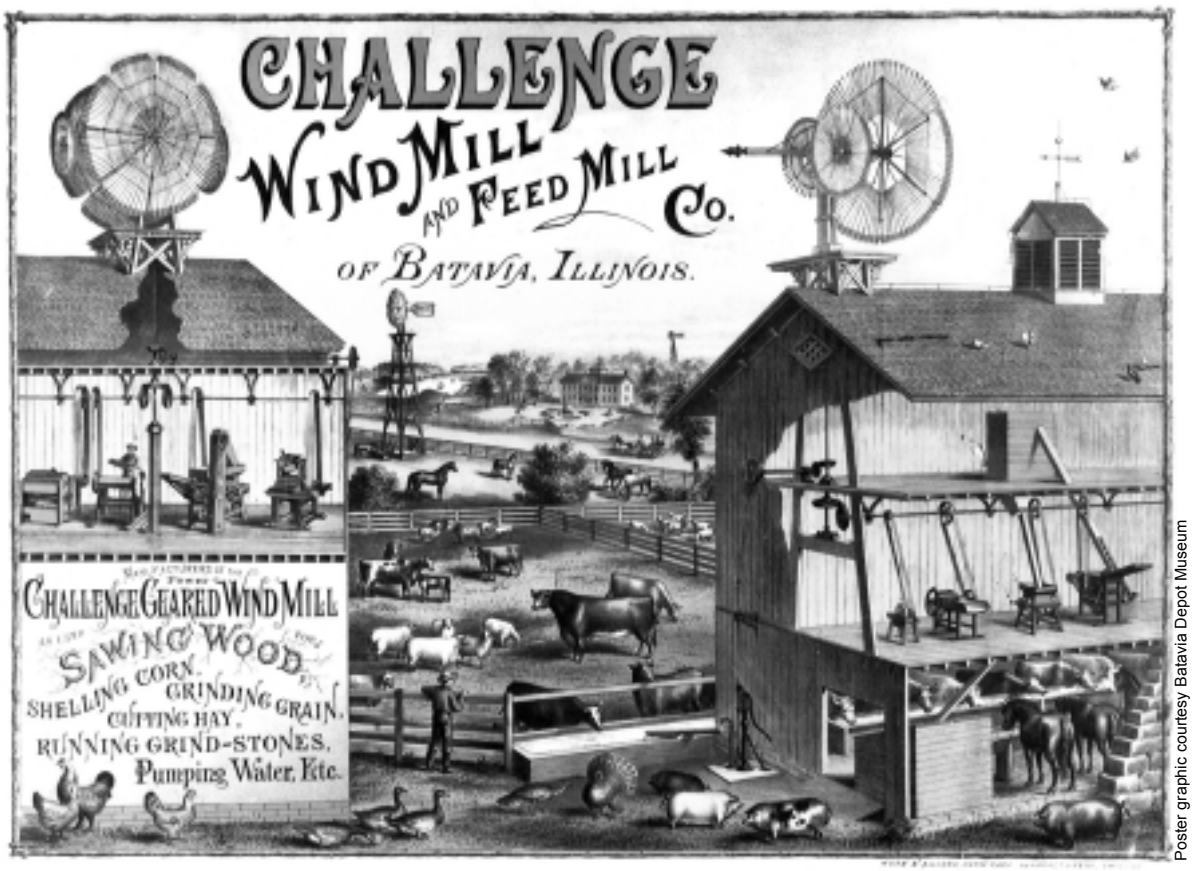
"The day that Fermilab [then the National Accelerator Laboratory] was announced is probably one of the most historic days for Batavia in the last century," said Batavia mayor Jeff Schielke. "Without Fermilab, Batavia would be very different today. The Fermilab site would have become another subdivision, and instead of being a city of 25,000 we would be a city of 50,000. Now we have this 6,800 acres of open space that we can enjoy."

The city's official nickname was soon changed from "The Windmill City" to "The City of Energy," honoring the lab's presence on the frontier of high-energy physics. In 1983, the city adopted a new logo that juxtaposes the Fermilab high-rise against a windmill, a symbolic link to its 19th-century heritage.

"The City of Energy is proud to have the high-rise as part of the logo, because [Fermilab] has such a positive impact on our community," said Schielke.

Schielke believes the description "City of Energy" also applies to the people of the community. Batavia's Riverwalk, created largely through volunteer effort, is considered the jewel of the Batavia Park District. The Riverwalk is a 12-acre peninsula on the Fox River that features a display of restored Batavia windmills.

As recently ten years ago, Batavia's windmill heritage was not highly visible in the city until Robert Popeck, Batavia's Administrative Assistant to the City, started the Windmill Restoration Project. The project, with the goal of locating and restoring one of each working windmill model that Batavia manufactured, currently has eight windmills on display, two in storage and many future windmill restoration plans. All of the windmills still have the ability to turn, and one of them can still pump water.



Poster graphic courtesy Batavia Depot Museum

The Challenge Company, founded in 1867, distributed this poster to agricultural implement dealers to advertise their windmills and farm equipment. Estimated to be from the 1890's or early 1900's, this style of poster has been found in many barns and farm offices.

As a collector of Batavia history, Popeck had always been interested in local windmills. After hearing the historian T. Lindsay Baker lecture about windmills, Popeck approached him and inquired about locating and restoring old Batavia windmills. Baker provided Popeck with a list of contacts, and the Windmill Restoration Project was under way. In the past several years, Popeck has established a network of windmillers and has traveled the country to collect Batavia windmills.

"Windmills are a very neat part of Batavia's history. No other city can claim to have it," said Popeck. "Windmills are just simple and pretty machines."

Popeck, who has a twelve-foot Batavia windmill in his front yard, receives at least one call a month from somebody who is looking for a windmill.

"I have received many positive comments about the display. I like to share my knowledge as much as I can with other people," said Popeck. "I know just enough to be dangerous."

Some historians credit the American windmill as one of the two inventions enabling the development of the American West (the other is barbed wire). Batavia can thus be credited with playing a major role in the western expansion that occurred following the American Civil War (1861-1865).

Founded in 1833 in the valley of the Fox River, Batavia, originally named "Head of Big Woods," was destined to be a city of industry and progress. The Fox River was the most valuable amenity to the early settlers because it was a source of power for the first Batavia businesses. The area also offered many natural resources for a variety of industries such as timber for the Newton Wagon Company, limestone for at least ten quarries, and rich soil for farmers. The windmill industry, however, is what put Batavia on the map.

In 1854, Daniel Halladay invented the first American windmill and founded the Halladay Windmill Company in Ellington, Connecticut. The primary function of the American windmill was to pump water, as opposed to the European windmill that served mainly as a gristmill. Having little success on the east coast, John Burnham, the company's general sales agent, relocated to Chicago to be closer to the windmill market. In 1857, after meeting some businessmen from Batavia, Halladay and Burnham relocated the

company and renamed it the U.S. Wind Engine and Pump Company. Within very little time, the company was thriving and produced thousands of windmills that were shipped around the world.

Windmill production boomed in Batavia, and in 1867 the Challenge Company was founded, followed by the Appleton Company in 1872. Although Batavia was at one point home to six windmill companies, the U.S. Wind Engine and Pump Company, the Challenge Company and the Appleton Company were the biggest and most famous windmill manufacturers of their time. By the 1890's Batavia was known as the windmill capital of the world and was nicknamed "The Windmill City."

The windmill industry flourished until electricity and electric pumps became more widely available in the 1930s. The major decline for the windmill occurred during World War II, when metal was needed for the war effort and windmills were not a priority.

It took a while for Batavia history to take a turn for the better.

On November 21, 1967, President Lyndon B. Johnson signed the bill commissioning the National Accelerator Laboratory (later renamed Fermi National Accelerator Laboratory in honor of Enrico Fermi), and Batavia was back on the map. What was once frontier for the American west became the wider frontier for high-energy physics. And although a windmill serves a very different purpose from that of an accelerator, both share the common threads of technology, progress and, of course, energy. After Batavia became the home of the most powerful particle accelerator in the world, the city's nickname changed from "The Windmill City" to "The City of Energy."

From the windmill to the accelerator, Batavia has grown accustomed to being at the frontier for modern technology—and might history repeat itself with windmills adapted as generators, in efforts to tap alternative energy sources?

The U.S. Department of Energy, for example, has its own Wind Energy Program, which helps utilities understand the benefits and challenges of using wind power by giving them the opportunity to operate wind power plants. And Popeck teaches local elementary and high school classes about the potentials of wind energy.

"Windfarms are popping up in Illinois, Iowa and Wisconsin, and there's one developing in Colorado," he said. "The wind generators have a span of 180 to 210 feet. I saw a huge windfarm in California devoted to energy production—it was a spectacular sight to see."

"The City of Energy is proud to have the high-rise as part of the logo, because [Fermilab] has such a positive impact on our community."

Batavia mayor Jeff Schielke

Photo by Reidar Hahn

No tax dollars have been spent on the windmill restoration project, funded entirely by private donations. Depending on the type and size, the windmills can range from $3,000 - $8,000. Wooden windmills are the most expensive because they usually require a lot of restoration and high maintenance.

FERMILAB ARTS SERIES

Website for Fermilab events: http://www.fnal.gov/faw/events.html

Dragon's Tale: Nai-Ni Chen Dance

March 8, 2003

Dragon's Tale is a feast for the eyes, mind, and heart. Bringing to life the culture and traditions of China, this full-length family show leaves children mesmerized at each enchanting, astounding dance, and adults equally caught up in the magic of it all.

Tickets- $19 ($10 ages 18 and under)

Quartetto Gelato

April 5, 2003

As the engaging innovators of a fresh approach to classical music, Quartetto Gelato has won the hearts of audiences worldwide since their remarkable 1994 debut season. The concert presentations combine supreme musicianship, irrepressible energy and charming wit, treating their listeners to an unforgettable musical event.

Tickets - $21 ($11 ages 18 and under)

To purchase tickets, or for further information or telephone reservations, **call 630-840-ARTS** weekdays between 9 a.m. and 4 p.m. Phone reservations are held for five working days, but will be released for sale if not paid for within that time. Will-Call tickets may be picked up, or available tickets purchased, at the lobby box office on the night of the performance beginning at 7 p.m. When coming to this event, only the Pine Street entrance to Fermilab will be open.

For more information, check out our web page at **www.fnal.gov/culture.**

MILESTONES

BORN

■ Jessica Nicole, to Jerry (Beams Division) and Leslie Leibfritz, on Jan. 23, 2003.

PHD AWARDED

■ To Theodore Vidnovic III, University of Minnesota, for research on the search for 2 π^0 (or pion) decays of charmonium at experiment E835 in December 2002.

EXPLORED

■ For the first time in 30 years, the old Linac RF5 accelerator tank. Johnathan Walters was one of the persons selected to crawl inside and facilitate the recent repair. This accelerator tank has not seen human hands or occupancy in 30 years. The photo also compares human size to the accelerator. Photo by Lester Wahl, Beams Division.

RETIRING

■ Michael McKenna, ID 2599, PPD-Mechanical Dept., Jan. 16

■ Elizabeth Brown, ID 2903, PPD-Support Service Department Jan. 16

■ Anthony Crawford, ID 5109, BD-DH-Beam Physics Dept., Jan. 16

■ Carol Ann Weissert-Jagger, ID 235, BS-SU Transport & Comm., Jan. 16

■ Frank Nezrick, ID 248, BD-NUMI, Jan. 17

■ Charlotte Smith, ID 8435, FES Engineering, Jan. 21

■ Joseph Gehard, ID 1549, FES Engineering, Jan. 21

■ Lawrence Vonasch, ID 873, BS –Procurement, Jan. 21

■ Donald Goloskie, ID 7192, PPD-Mechanical Dept. Jan. 21

■ Patricia Sorensen, ID 3291, LS-AO-Users Office, Jan. 22

■ Armand Bianchi, ID 882, TD-Development & Test, Jan. 22

■ Masanori Mishina, ID 3815, PPD-EPP-Guests & visitors, Jan. 22

■ Jeffrey Ruffin, ID 386, BD-RF Department, Jan. 22

■ Larry Thompson, ID 10283, LS-Training and Development, Jan. 22

■ Jay Hoffman, ID 5952, TD-Engineering, Jan. 22

LUNCH SERVED FROM
11:30 A.M. TO 1 P.M.
$10/PERSON

DINNER SERVED AT 7 P.M.
$23/PERSON

Chez Léon MENU

FOR RESERVATIONS, CALL X4512
CAKES FOR SPECIAL OCCASIONS
DIETARY RESTRICTIONS
CONTACT TITA, X3524
HTTP://WWW.FNAL.GOV/FAW/EVENTS/MENUS.HTML

LUNCH
WEDNESDAY, FEBRUARY 19

Closed

DINNER
THURSDAY, FEBRUARY 20

Lentil soup
Grilled sea bass with lime cilantro butter
Sauteed corn, chilies and pepper in cream
Crepes with maple bohed fruit

LUNCH
WEDNESDAY, FEBRUARY 26

Chicken curry
Jasmine rice
Cucumber, tomatoes, pepper and red onion salsa
Lime coconut tart

DINNER
THURSDAY, FEBRUARY 27

CARNIVAL
Sancocho with yaca fritters
Roast suckling pig
Pigeon peas and rice
Stewed chayote
Flan de pina
Tropical fruit salad

FERMI NEWS

FERMILAB
A U.S. DEPARTMENT OF ENERGY LABORATORY

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The deadline for the Friday, March 7, 2003 issue is Tuesday, February 25, 2003.
Please send classified ads and story ideas by mail to the Public Affairs Office, MS 206, Fermilab, P.O. Box 500, Batavia, IL 60510, or by e-mail to ferminews@fnal.gov.
Letters from readers are welcome.
Please include your name and daytime phone number.

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CLASSIFIEDS

FOR SALE

■ '96 Chevrolet S-10 LS extended cab pickup, black, 6 cyl 4.3 L Vortec engine, 72K miles, 5-spd. manual, tachometer, AM/FM stereo cass., tilt, cruise, power door locks, p/windows, p/mirrors, limited slip differential, fog lights, A/C, ABS, aluminum/alloy wheels, spray-in bedliner, tonneau cover. No dents, door dings or rust. Synthetic oil used in engine, transmission and differential since new. One owner. $6,350 Contact Randy Sales 630-840-8031(work) or 630-587-9419 (after work)

■ '95 Jeep Grand Cherokee 4 X 4, fully loaded, excellent condition, high miles but well maintained. $5,200 o.b.o. Contact Shane at 630-742-4211.

■ '79 Lincoln Town Coupe, 68K original miles, full power, have all receipts, dove gray with burgundy velour interior. Classic soon to be antique. $5,000 o.b.o. Contact Tom 630-840-8122, 630-935-6470.

■ Items from a 2001 Dodge Ram 1500 shortbed 4wd, will fit any shortbed 2001 and older with that body style. A.R.E. fiberglass tonneau cover with underside carpeted liner upgrade, Dodge bedliner, carbon fiber headlight covers, carbon fiber taillight covers, rear window sun valance (white painted), bug guard with eyebrows (2 sets, one white, one smoke), K&N air filter kit, stock air filter setup, complete. All for $850 o.b.o. Also available, Pioneer Premier DEH-P730 head unit, 50w X 4 channel, with digital graphics faceplate, steering wheel control unit, and removable faceplate. $250, or $200 if purchased with the rest. Please contact stephens@fnal.gov or 630-879-6291.

■ 2 Brand New 400W floor standing speakers. Pro Dynamics series 1200 TX. Frequency Range: 20 - 21000 Hz. 8 Ohm Impedance. 90db (1W/1M). 5 Year Warranty. Never used. Retail for $1,100 each. Selling BOTH for $1,000 o.b.o. Contact 815-761-2289 or strothmn@fnal.gov.

■ Sun Sparc 20, 448MB RAM, 20" Monitor, int and ext hard drives, QFE, floppy, cd-rom, Frame Buffers and a bunch of misc network and SCSI adapters. Take everything I have for $425. Contact Joe at 630-840- 3311 or jklemenc@fnal.gov for a complete list.

■ Gas range/stove, white, and 18 cu.ft. refrigerator, avocado, both work very well. $150 for the pair. Contact Karl at 630-840-3043 or 630-978-1166 eves.

■ Mattress Pad: Brand new, unopened, Queen (60″x80″), Simmons Beautyrest 250 thread count Cotton Sateen Stripe Mattress Pad. Deluxe w/ expandable skirt holds firmly to mattresses up to 15″ deep. 10 yr warranty. Paid $35, asking $25 o.b.o. Mattress Pad: Quilted, double/full sized mattress pad with expandable skirt. Used, in very good condition. $7 o.b.o. Vacuum Cleaner: Eureka, "Blue Ribbon, Edge Kleener", upright, bag vacuum. Older model, in excellent working condition. $20 o.b.o. Contact Adam at 630-840-5522 or lyon@fnal.gov.

■ Kenmore washer and gas dryer, about 8 years old, $150 for both. 4 tires and wheels from 1990 Mustang, $80. Contact Randy at 630-964-2311 or rlw58@yahoo.com.

■ Treadmill, PRO-Form 730 CS, with full functions. Only used a few times, bought at $799. Asking $400. Full size bed, frame with mattress. Almost new, asking $400. Student desk, asking $20. Nightstand, two asking $20. Call 630-840-2710 daytime or 630-305-8493 evening.

■ DP adjustable weight bench with leg lift and butterfly attachment and bar bell set. $25 for all. Contact Mark at 630-840-2253.

BIBLE STUDY

■ Bible Study group meets every Wednesday at noon (12-12:30 pm) in the Huddle (by the Control Room). The current study is entitled 'Journey Into Happiness.' Check out the #1 best seller of all time for yourself - with no strings attached. All are welcome. Info at 840-3607 or dykhuis@fnal.gov.

CALENDAR/LAB NOTES

Website for Fermilab events: http://www.fnal.gov/faw/events.html

BLOOD DRIVE

■ Fermilab's annual blood drive will be held on February 17 and February 18, 2002 from 8 a.m. to 3 p.m. at Wilson Hall, Ground Floor NE Training Room. Appointments can be scheduled on the web at: http://www-esh.fnal.gov or by calling Lori at x6615. The blood shortage is at critical levels. Please help if you can.

FERMILAB CHILDREN'S SUMMER DAY CAMP

■ Registration begins March 1. Deadline is March 28. A lottery drawing is held March 31 for acceptance into the camp. Information can be found in the Recreation Office, WH15W, x2548, x5427 and on the Recreation web page at http://fnalpubs.fnal.gov/benedept/recreation/dependent.html.

CALL FOR ENTRIES

Fermilab Arts and Craft Show

May 1, 2003 to June 2, 2003.

■ Open to all Fermilab employees, visiting scientists or graduate students, retired employees, contractors and any member of his or her immediate family. Pick up applications at Atrium Desk. Questions?? Contact 630-840-6825 or Georgia@fnal.gov.

HOUSING ASSIGNMENTS – SUMMER 2003

■ The Fermilab Housing Office is now taking requests for houses, apartments, and dormitory rooms for the Summer of 2003. Since there will be a large influx of experimenters, and requests are anticipated to be in excess of our available facilities, you are urged to submit your request for reservations to the Housing Office **by Monday, March 3, 2003.** Requests can be made for any period and need not commence on any particular date.

For further information, please contact the Housing Office at: Telephone: 630-840-3777, fax: 630-840-2823, email: housing@fnal.gov

Individual housing requests can be made by using our Online Housing Request form at http://fnalpubs.fnal.gov/housing/housing_request.html

(Requests for multiple housing units are best handled by direct email to housing@fnal.gov.)

URA SCHOLARSHIPS REQUIRE SAT TEST SCORES

■ Universities Research Association (URA) awards a number of scholarships to children of regular, full-time Fermilab employees. URA scholarships are awarded on the basis of SAT (Scholastic Aptitude Test) scores. Scholarship candidates must be high school seniors who will begin a four-year college degree program in the fall. The maximum amount of the scholarship is $3,500 for tuition and fees, and is renewable for four years for students in good academic standing. Applications are available January 1 through March 1. Scholarships will be awarded in early April. Questions about the program may be directed to Jeannelle Smith of Human Resources, Mail Station 124, x4367.

http://www.fnal.gov/pub/ferminews/

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